INSTRUCTIONS

FUEL-INJECTION PUMP GE LARGE BENDIX SYSTEM

FOR

GE DRAWING 41D713582G4 GE PART 132X1254-1
GE DRAWING 41E902836G1 GE PART 132X1510

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SCOPE

This instruction covers the Bendix fuel-injection pump, Part 132X1254, which has been used on GE diesel engines since 1967. It also covers an improved design Bendix pump, Part 132X1510 which will be used in limited production starting in late 1978.

The two types of pumps are very similar in exterior appearance. They can be identified by the nameplate, and the Part 132X1510 pump can be further identified by the small hole in the face of the housing base, Fig. 1.

Internally the two types of pumps are quite different. The major differences exist in the following parts of the Part 132X1510 pump:

1. Housing – has identification hole in the face of the housing base.
2. Lower spring plate – has two milled flats on opposite sides of the outside diameter.

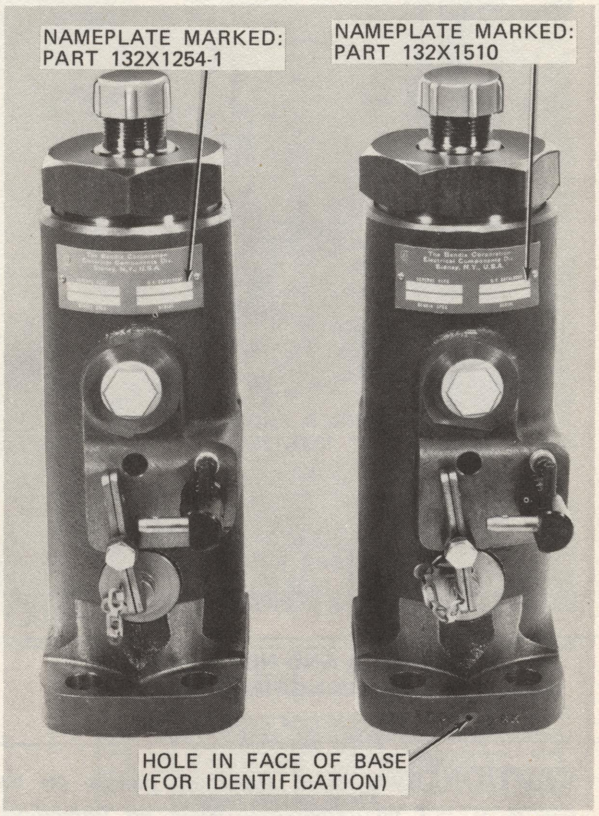
NAMEPLATE MARKED: PART 132X1254-1
NAMEPLATE MARKED: PART 132X1510
HOLE IN FACE OF BASE (FOR IDENTIFICATION)

FIG. 1. BENDIX FUEL-INJECTION PUMPS.

FIG. 1, E-25143

3. Plunger and barrel assembly – this must be a matched set. While the barrel is the same as previously used barrels, the plunger is radically different; it has two different helices on each side of the plunger outer surface, Fig. 2.
4. Delivery valve assembly – a new design. Identified by a new stamped part number.

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*Revisions are indicated by marginal bars.

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the General Electric Company.

Verify numbers for parts, tools, or material by using the Renewal Parts or Tool Catalogs, or contact your General Electric representative for assistance. Do not order from this publication.

For Parts See
GEG-16252

GENERAL ELECTRIC

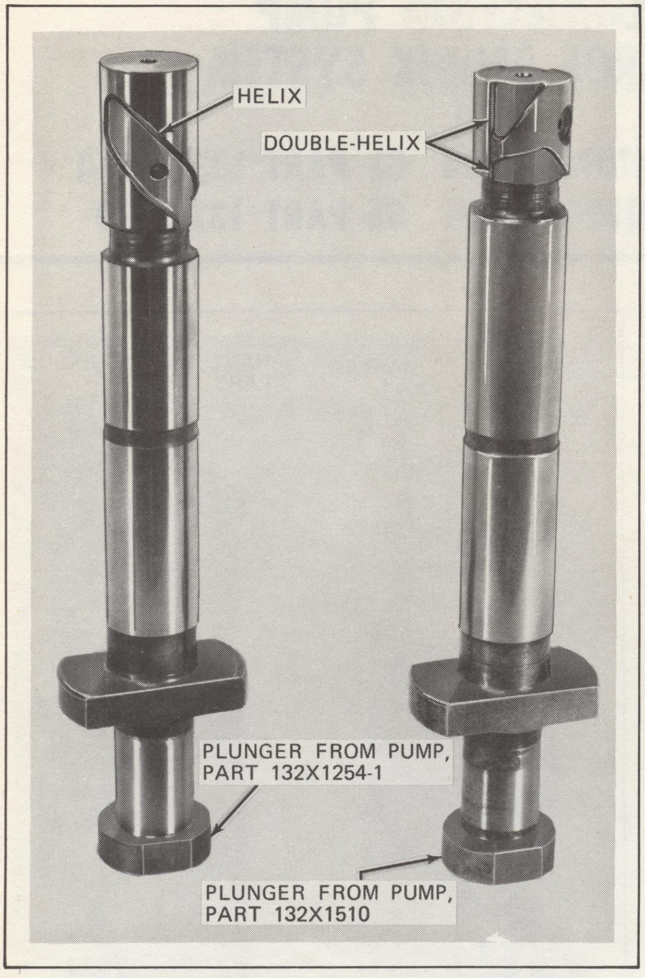

HELIX
DOUBLE-HELIX
PLUNGER FROM PUMP, PART 132X1254-1
PLUNGER FROM PUMP, PART 132X1510

FIG. 2. OLD AND NEW PLUNGERS SHOWING HELICES.

FIG. 2, E-25144

CAUTION: *Using both types of pumps on an engine is not recommended. While no immediate mechanical damage will result from mixing pumps, optimum fuel consumption will not be realized and prolonged use may result in engine damage.*

DESCRIPTION

Fig. 3 shows a typical diesel fuel-injection system with the main parts of the installation labeled and referenced according to GE part numbers.

The fuel pumps are of the constant-stroke type known as impulse or "jerk" type pumps. They are operated from the engine camshaft by an adjustable tappet-rod arrangement.

The pumps serve three purposes:

1. To raise the fuel-oil pressure to a pressure necessary for efficient atomization of the fuel
2. To meter the desired quantity of fuel to the injection nozzle as required by the governor
3. To time the delivery of the fuel to be injected at a definite point in the engine cycle and within a limited number of degrees of engine crankshaft rotation.

The pump consists principally of:

1. Pump housing
2. Delivery-valve assembly
3. Delivery-valve holding nut
4. Plunger, barrel, plunger return spring and seat
5. Geared control sleeve and the control rack with which it engages.

OPERATION

NOTE: *This description of operation which follows, applies to the Part 132X1254 pump. With only minor detail changes it is equally applicable to the Part 132X1510 pump.*

The plunger return spring (5), Figs. 4 and 5, holds the lower spring plate (3), which in turn holds plunger (4) against the plunger follower (2). The plunger follower rides the engine tappet. The engine tappet moves the plunger up and is returned by the plunger spring, thus completing the pumping cycle. The barrel is stationary. The pump works on a constant stroke, and fuel output is variable. The plunger stroke is constant in that it travels the same distance at all engine speeds. To vary the fuel output of the pump, the plunger is rotated by means of its crossbar, the control sleeve (7), control rack (17), and throttle or governor linkages. A closer look at the barrel and plunger-assembly design will show how plunger rotation affects fuel output.

To pump fuel to high pressure, it is necessary to bring it into a pressure chamber through an inlet, close the inlet, apply pressure for injection, terminate injection pressure, and reopen the inlet to admit more fuel. This fuel-injection cycle is accomplished partially by location of ports in the barrel. See Fig. 6. It is further accomplished by metering helices and a passage in the plunger that extends from the end of the plunger to the metering helices on either side of the plunger. This passage allows fuel in the pressure chamber to spill into the inlet chamber when the helices uncover the barrel port.

The port is a passage which allows fuel to enter the barrel from the pump-inlet chamber and through which high-pressure fuel spills to end injection. The metering helices get their name from their function and shape. Their

FIG. 3, E-15211A

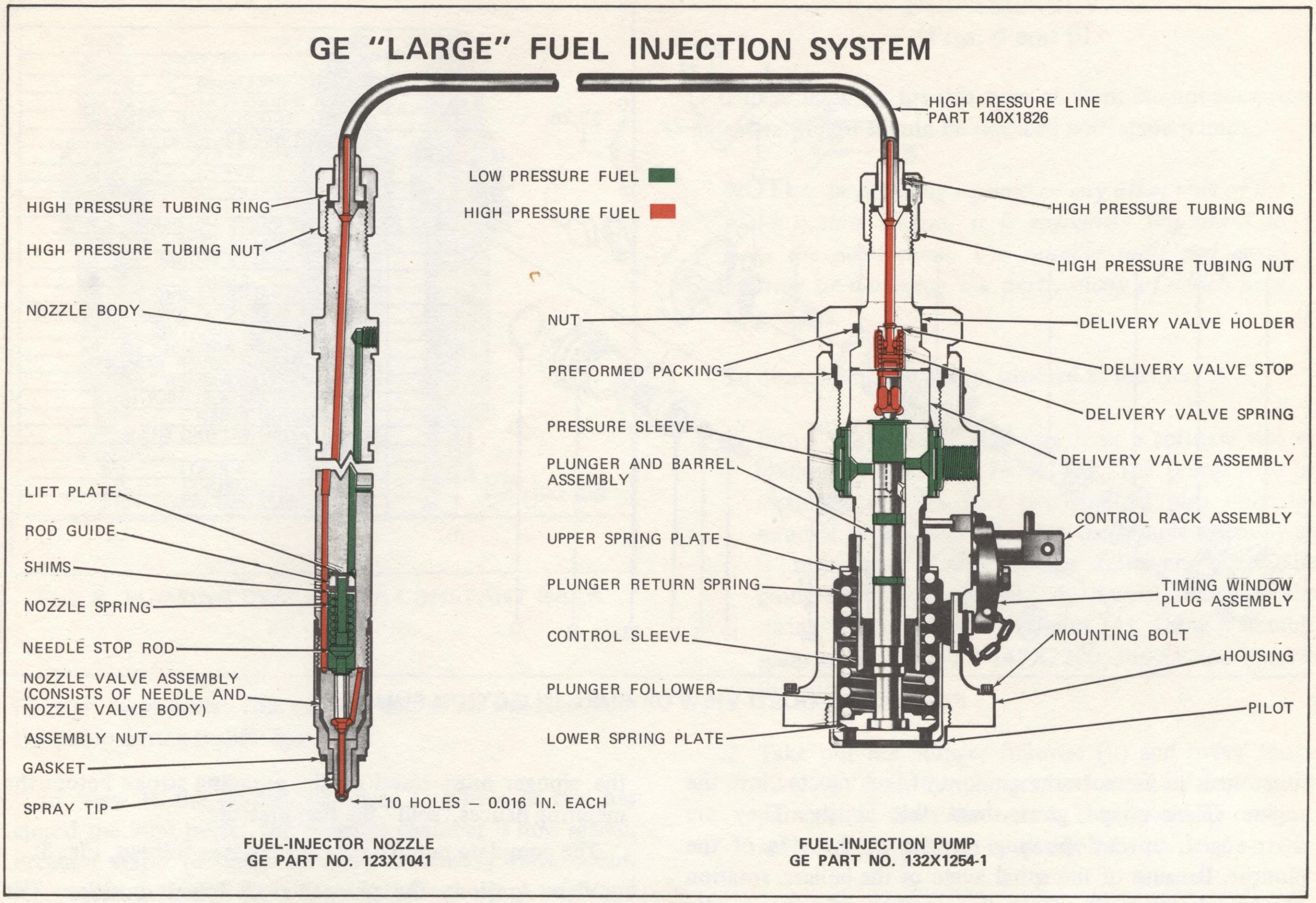
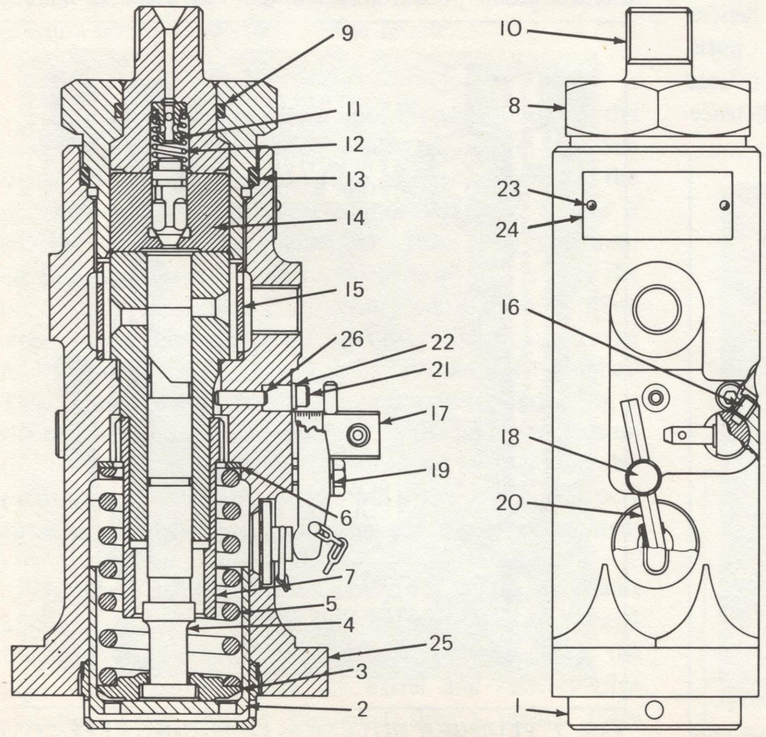

GE "LARGE" FUEL INJECTION SYSTEM
HIGH PRESSURE LINE PART 140X1826
LOW PRESSURE FUEL 🟩
HIGH PRESSURE FUEL 🟥
HIGH PRESSURE TUBING RING
HIGH PRESSURE TUBING NUT
NOZZLE BODY
LIFT PLATE
ROD GUIDE
SHIMS
NOZZLE SPRING
NEEDLE STOP ROD
NOZZLE VALVE ASSEMBLY (CONSISTS OF NEEDLE AND NOZZLE VALVE BODY)
ASSEMBLY NUT
GASKET
SPRAY TIP
10 HOLES – 0.016 IN. EACH
FUEL-INJECTOR NOZZLE GE PART NO. 123X1041
NUT
PREFORMED PACKING
PRESSURE SLEEVE
PLUNGER AND BARREL ASSEMBLY
UPPER SPRING PLATE
PLUNGER RETURN SPRING
CONTROL SLEEVE
PLUNGER FOLLOWER
LOWER SPRING PLATE
HIGH PRESSURE TUBING RING
HIGH PRESSURE TUBING NUT
DELIVERY VALVE HOLDER
DELIVERY VALVE STOP
DELIVERY VALVE SPRING
DELIVERY VALVE ASSEMBLY
CONTROL RACK ASSEMBLY
TIMING WINDOW PLUG ASSEMBLY
MOUNTING BOLT
HOUSING
PILOT
FUEL-INJECTION PUMP GE PART NO. 132X1254-1

FIG. 3. FUEL-INJECTION PUMP, LARGE SYSTEM.

FIG. 4, E-16071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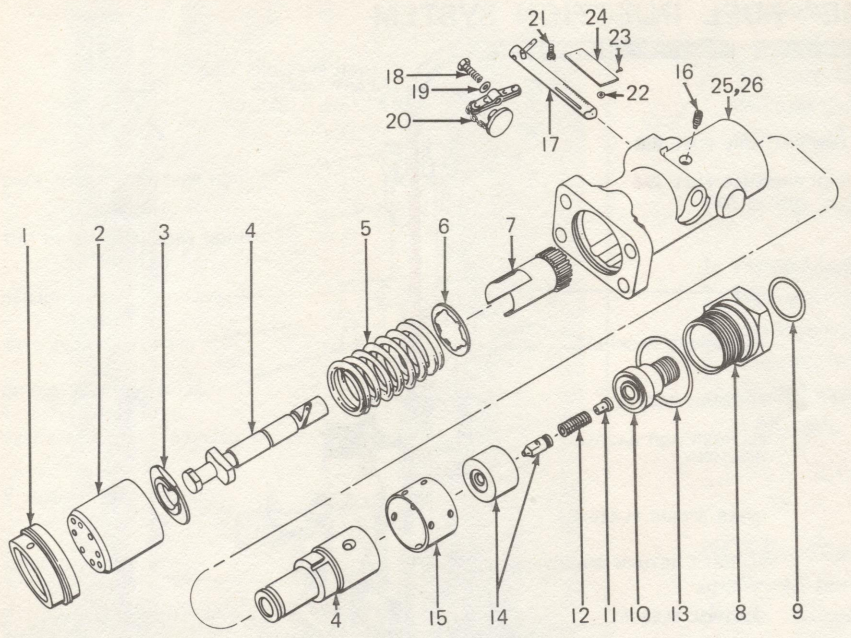
REF.	DESCRIPTION
1	PILOT
2	PLUNGER FOLLOWER
3	LOWER SPRING PLATE
4	BARREL AND PLUNGER ASSEMBLY
5	PLUNGER RETURN SPRING
6	UPPER SPRING PLATE
7	CONTROL SLEEVE
8	DELIVERY-VALVE HOLDER NUT
9	PACKING
10	DELIVERY-VALVE HOLDER
11	DELIVERY-VALVE STOP
12	DELIVERY-VALVE SPRING
13	PACKING
14	DELIVERY-VALVE ASSEMBLY
15	EROSION SLEEVE OR PRESSURE SLEEVE
16	CONTROL-RACK LOCATING SCREW
17	CONTROL-RACK ASSEMBLY
18	TIMING-WINDOW COVER CAPSCREW
19	CAPSCREW LOCKWASHER
20	TIMING-WINDOW ASSEMBLY PLUG
21	CALIBRATION SCREW
22	CALIBRATION SETTING SHIM
23	DRIVE SCREW
24	IDENTIFICATION PLATE
25	HOUSING ASSEMBLY
26	BARREL-LOCATING DOWEL PIN

FIG. 4. FUEL-INJECTION PUMP ASSEMBLY.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REF.	DESCRIPTION
1	PILOT
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9	PACKING
10	DELIVERY-VALVE HOLDER
11	DELIVERY-VALVE STOP
12	DELIVERY-VALVE SPRING
13	PACKING
14	DELIVERY-VALVE· ASSEMBLY
15	EROSION SLEEVE OR PRESSURE SLEEVE
16	CONTROL-RACK LOCATING SCREW
17	CONTROL-RACK ASSEMBLY
18	TIMING-WINDOW COVER CAPSCREW
19	CAPSCREW LOCKWASHER
20	TIMING-WINDOW ASSEMBLY PLUG
21	CALIBRATION SCREW
22	CALIBRATION SETTING SHIM
23	DRIVE SCREW
24	IDENTIFICATION PLATE
25	HOUSING ASSEMBLY
26	BARREL-LOCATING DOWEL PIN

FIG. 5, E-16072

FIG. 5. EXPLODED VIEW OF FUEL-INJECTION PUMP.

function is to measure the amount of fuel injected into the engine. Their shape gives them this ability. They are sharp-edged, upward-spiraling recesses in the side of the plunger. Because of the spiral angle of the helices, rotation of the plunger will affect the amount of plunger rise required for them to uncover the port. The effective stroke, then, is the distance between the upper edge of the helices and the lower edge of the port at the instant that inlet ports close, Fig. 7. Thus, the rotation of the plunger helices determines the duration of injection by varying the distance the plunger must travel on the pumping stroke before the metering helices "spill" the fuel pressure.

The complete pumping cycle then is as follows, Fig. 8:

View A shows the plunger at its lowest position. The delivery valve is closed. The inlet ports are open. Because of transfer-pump pressure, fuel enters the pressure chamber

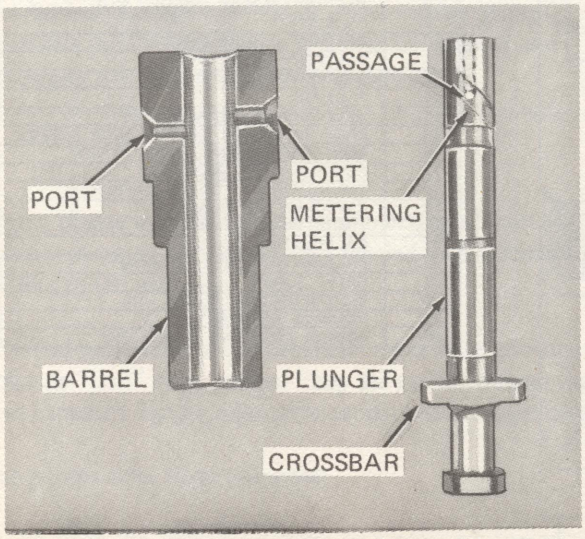

PASSAGE
PORT
PORT
METERING HELIX
BARREL
PLUNGER
CROSSBAR

FIG. 6. CUT-AWAY VIEW OF PLUNGER AND BARREL.

FIG. 6, E-16076

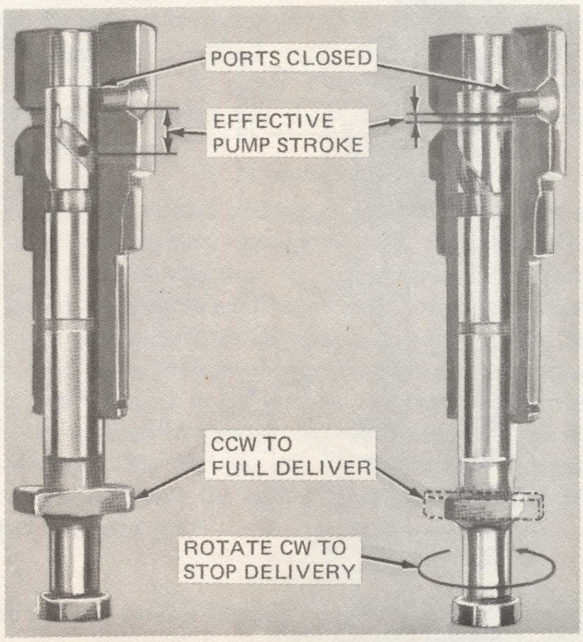

PORTS CLOSED
EFFECTIVE PUMP STROKE
CCW TO FULL DELIVER
ROTATE CW TO STOP DELIVERY

FIG. 7. PLUNGER ROTATION CHANGING EFFECTIVE STROKE.

FIG. 7, E-16073

E-16076

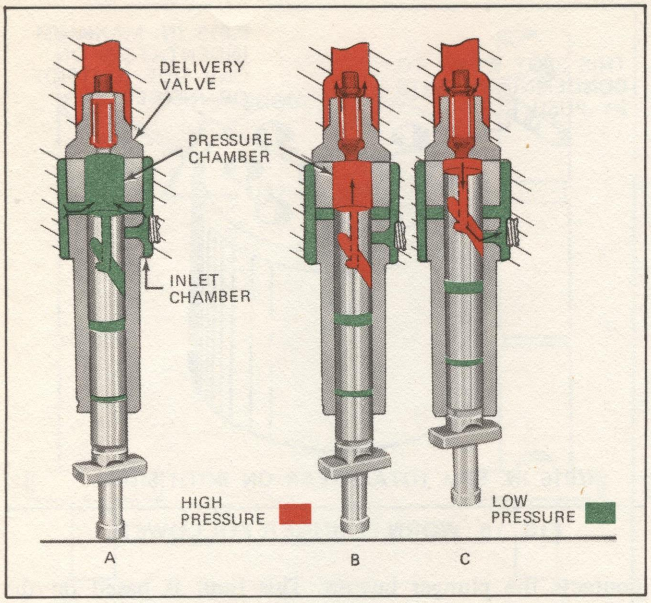


FIG. 8, E-16106

FIG. 8. PUMPING CYCLE WITH CONSTANT RACK SETTING.

through these ports. This assumes that all air was bled from the pump during installation.

In View B, the plunger has risen to where its end has closed the inlet ports. The pressure chamber is now sealed. Pressure starts to build up and the delivery valve opens. High-pressure fuel is forced through the delivery valve and the high-pressure line. Injection of fuel into the engine begins the instant that the line pressure exceeds the pressure setting of the fuel-injector nozzle.

Fuel injection will continue until the upper edges of the metering helices reach the lower edge of the spill port. See View C, Fig. 8. At this instant the high-pressure fuel in the pressure chamber, plunger center-passage, and helices is released into the inlet chamber. This stops injection, because high-pressure line pressure drops and allows the nozzle valve to close. The delivery valve assembly then closes. From this point to the top of the plunger stroke, the fuel in the pressure chamber spills into the inlet chamber. This means the effective stroke, or duration of injection, is the distance the plunger travels from the inlet-port closure to the spill-port opening. It can now be seen that by rotating the plunger the helices will arrive at the spill port either sooner or later, depending on which way it is rotated.

The closed delivery-valve assembly, Fig. 4 (14), maintains a column of fuel in the line between the pump and fuel-injector nozzle. Precision-lapped surfaces keep the high fuel pressure within the barrel and delivery-valve chamber. Only trained personnel should service these precision surfaces.

DISASSEMBLY
(Figs. 4 and 5)

If local facilities for this type of work are not adequate, defective pumps should be replaced with spare pumps.

NOTE: *In servicing a pump or any other unit of the fuel-injection system, it is extremely important to keep the parts clean. Use suitable tools and avoid marring or damaging the parts, many of which have lapped fits.*

To disassemble the pump, proceed as follows:

1. Invert the pump and secure it in a soft-jaw vise or holding fixture, Part 147X1732. The pump is to be mounted on the first two holding pins only for removal of the pilot (1). Place the spindle assembly so it rests against the plunger follower. Force the plunger-follower assembly downward, relieving the spring tension against the pilot (1). Using a suitable spanner wrench, Part 147X2200, loosen and remove the pilot (1).

2. Take out the plunger follower (2) and lower spring plate (3) from the plunger, and carefully remove the plunger (4) from the barrel. Using extreme caution, submerge the plunger in spindle oil.

3. Remove the plunger return spring (5) from the housing.

4. Fabricate a puller as shown in Fig. 9, if required, to remove the control sleeve (7) and upper spring plate (6). Insert the tip of the puller between the end of the barrel (4) and the undercut inside the control sleeve (7). The upper spring plate (6) will come out with the control sleeve.

5. Invert the housing (25). Remove the delivery-valve holder nut (8) with the delivery-valve holder (10) inside. Remove the holder (10) from the nut (8), and discard the packing (9), located in the nut recess, and the packing (13) found on the outside of the nut (8).

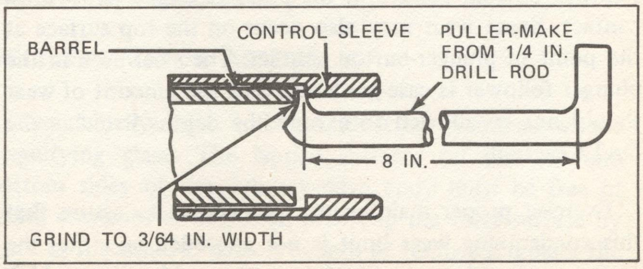


FIG. 9, E-16074

FIG. 9. DIMENSIONS AND APPLICATION OF PULLER.

6. Remove the delivery-valve stop (11) and spring (12) from the top of the delivery-valve assembly.

7. Insert a blunt wooden rod, e.g., a mallet handle, in the bottom of the pump housing, and gently push out the delivery-valve assembly (14) and barrel (4). Use your fingers to slide out the erosion sleeve (15).

> **CAUTION:** *When handling either the delivery-valve holder (10), or delivery-valve assembly parts (14), use extreme care to prevent any damage to the precision-lapped surfaces. The plunger and barrel assembly are mated to precision tolerances at the factory and should never be interchanged with other parts. If, at overhaul, it becomes necessary to replace either of these parts, a new assembly must be purchased.*
>
> *The parts of the delivery-valve assembly (14) are mated. Do not mix the parts of various assemblies. Mixing parts will alter fuel delivery and timing, causing engine inefficiency.*

INSPECTION

GENERAL

In general, it will be found that very little wear has taken place on the parts. Abnormal conditions, such as dirt or water in the fuel oil, may have caused damage to the extent that parts will require replacement.

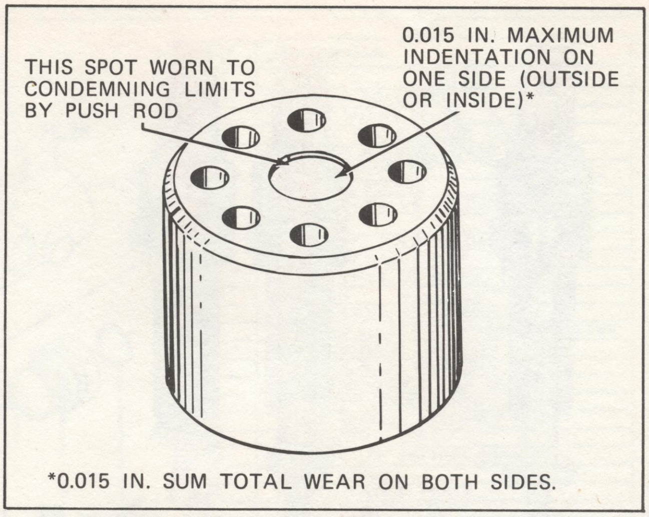
Serviceability of the various parts will be determined by the calibration specifications for the pump.

Thoroughly clean all the parts in clean fuel oil. Be careful not to touch the plunger sides with your hands. Handle it at all times by the button end. The same precautions should be taken when handling the plunger barrel, the delivery-valve body and the delivery-valve holder; do not allow the hands to touch the lapped surfaces.

PLUNGER-FOLLOWER WEAR (Figs. 10 and 11)

Normal fuel-pump operation will wear the plunger follower bottom surface at the point of engine tappet-rod contact. Some wear may also occur on the top surface at the point of plunger-button contact. The steel used in the plunger follower is case-hardened, and the amount of wear should not be allowed to exceed the depths listed in the DATA section.

Exercise proper maintenance procedures to assure that this condemning wear limit is not exceeded on either the engine push-rod contact point or the inside point which contacts the plunger button. This limit is based on the hardened depth of this point.


THIS SPOT WORN TO CONDEMNING LIMITS BY PUSH ROD
0.015 IN. MAXIMUM INDENTATION ON ONE SIDE (OUTSIDE OR INSIDE)*

*0.015 IN. SUM TOTAL WEAR ON BOTH SIDES.

FIG. 10. WORN PLUNGER FOLLOWER.

FIG. 10, E-9970B

Check the follower for cracks, using a magnifying glass. Renew it if any cracks are found.

Damage to the engine tappet rod, crosshead roller, and fuel pump may result if a complete failure of the plunger follower occurs, which in turn will cause improper pump timing.

PLUNGER-BUTTON WEAR

In normal service, contact between the plunger button and the follower cup eventually causes wear on the button. This also affects the timing of the pump to the engine.

This surface can be measured easily by using a lower spring plate and depth micrometer, Fig. 11. Measure from the bottom to the plunger-button seat of the lower spring plate (A). Next, suspend the plunger in the plate and measure from the bottom of the plate to the center of the plunger button (B). A minus B equals plunger-button thickness (C). If this dimension (C) is less than 0.240 in. replace the plunger and barrel assembly.

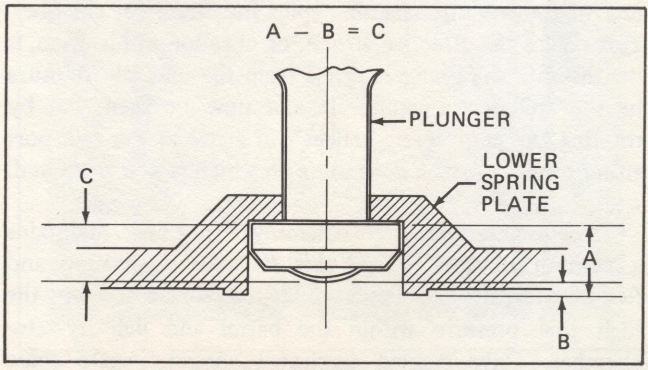


FIG. 11. MEASURING PLUNGER-BUTTON WEAR.

FIG. 11, E-16075A

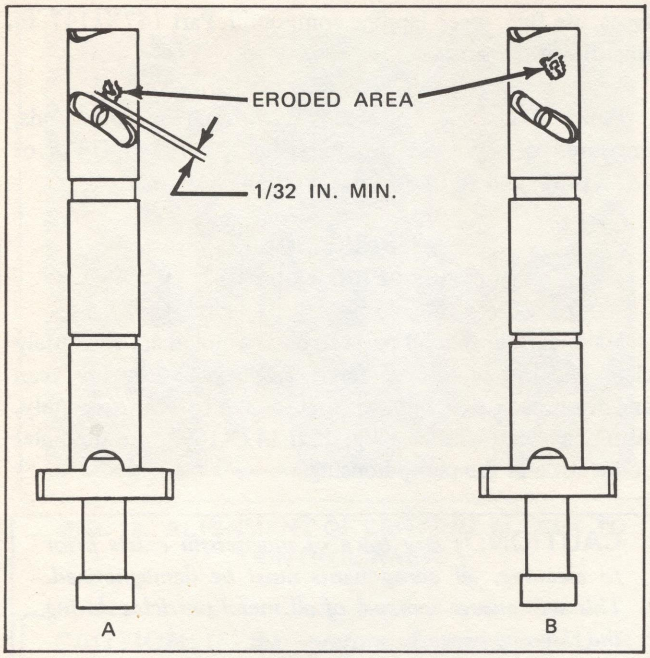


FIG. 12. PLUNGER EROSION.

FIG. 12, E-13402

PLUNGER AND BARREL ASSEMBLY (Fig. 6)

The plunger and barrel are mated as a pair. If either of these parts is defective beyond repair, both parts must be renewed.

Check the plunger for scratches, scuff marks, erosion or pit marks on the lapped surface. Check the helices for wear, etching or rough edges.

Limited pitting or erosion of the plunger is permissible if the eroded area is not within 1/32 in. of the upper or leading edge of the metering helix. The length of the particular engine run between overhaul periods will determine whether a minimum other than 1/32 in. should be established. If the leading edge of the metering helix becomes broken by this erosion, it will seriously affect pump timing and fuel delivery, Fig. 12.

Examine the flat lapped surface of the barrel, which contacts the delivery-valve body, for scratches, pit marks or etching. These defects, if not too serious, may be removed by lapping the damaged surfaces.

Check the port holes in the barrel for wear or cracks. Use an otoscope, Part 147X1871, for checking the bore for score marks, wear, or any obstruction in the central and cross holes in the top end of the plunger.

Discoloration and lacquer deposits can be removed by using a felt pad and mutton tallow. Plungers usually have a dull grayish appearance, which is not necessarily an indication of wear. Place the plunger in a lapping lathe, apply a small amount of lapping compound, and polish the plunger with a paper towel while it rotates.

If these parts pass the final inspection, wash them in a suitable cleaner and blow them dry with clean filtered air. Lubricate the parts with clean, light oil.

WARNING: *Solvents may be toxic or flammable and cause harmful or fatal injury. For safety, use only with adequate ventilation; avoid contact with skin; avoid inhalation of fumes; and do not expose to flame or sparks.*

Be very careful not to damage the edges or lapped surfaces when assembling the plunger and barrel. Do not force the plunger into the barrel. The plunger should slide into the barrel freely by its own weight and must be free of stickiness over the entire length of travel.

PLUNGER RETURN SPRING

The plunger return spring should be checked for broken ends and pits and for being out-of-square. If it is defective, replace the spring. Rust or extremely heated condition will also be cause for replacement.

NOTE: *Current-production springs are resin coated whereas previously these springs were zinc plated. Never wire brush either type of spring, and never clean in a caustic or acid bath. Clean springs only in clean mineral spirits or fuel oil.*

DELIVERY-VALVE HOLDER

The flat lapped surface of the delivery-valve holder (10), which contacts the top lapped surface of the delivery valve body, must be free of nicks, scratches, corrosion or other contamination. If surface is damaged to any measurable depth, replace the part. Otherwise, lightly lap to remove all surface distortion. The outside surface, which contacts the preformed packing, must be free of burrs and grooves. Use 320 grit emery cloth to correct this area. Clean the threads with a die nut, if required.

DELIVERY-VALVE ASSEMBLY

The delivery valve and seat must be examined with a magnifying glass. The lapped surfaces on the top and bottom sides of the delivery-valve body must be free of nicks, scratches or corrosion pits. Lap the valve surface by hand or machine. If defects cannot be removed, replace the valve and seat.

Wash all the parts in clean fuel oil, blow them dry, and lubricate them with a light lubricating oil before assembly.

Check the delivery-valve spring for pits and broken ends and for being out-of-square. If the spring is defective, replace it. Rust or extremely heated condition will also be cause for replacement.

CONTROL RACK AND SLEEVE

Check the control rack and control sleeve for wear or embedded dirt and lacquer deposits. Check the linkage end of the rack for excessive wear.

Renewal of these parts is indicated if the tooth wear is excessive, or if the plunger guide slots are badly worn. Combined lost motion should not exceed the maximum given in the DATA section.

EROSION SLEEVE

Inspect the erosion sleeve. If it shows any signs of severe pitting or erosion, replace the sleeve.

On the plunger upstroke, a high-velocity jet of fuel is released into the pump inlet chamber. The force of this jet of fuel is so great that, in time, it will erode the hardest of metals. To prevent erosion damage to the pump housing, the renewable case-hardened sleeve is used to break up the jet of fuel.

PUMP HOUSING

Check the pump housing for cracks above the rack openings near the locating screw and around the mounting bolt holes. If there are cracks, scrap the pump housing. Check the inside of the housing around the barrel seat for signs of excessive erosion.

Assure the inside of the pump housing is clean and free of rust, scale, or particles of metal chips. Clean the threads with a tap, if necessary.

FLAT LAPPED SURFACES

These surfaces are: the lower face of the delivery-valve holder, both faces of the delivery-valve body, and the top face of the barrel.

Examine for nicks, scratches, corrosion or lacquer deposits. If found, use a lapping machine, Part 147X1616 or 147X1618, or a manual-type lapping block, Part 147X1145, to refinish these surfaces. Remove only minimum material from parts. Use coarse, yellow lapping compound, Part 147X1148, to initially finish the lapped faces; use fine, green lapping compound, Part 147X1147, to final-finish the surfaces.

Finished surfaces must be flat within two light bands, measured with a monochromatic light, Part 147X1415 or 147X1452, and an optical flat, Part 147X1416.

REASSEMBLY
(See Figs. 4 and 5)

Make certain that all parts to be assembled are absolutely clean and free of any protective coatings. Thoroughly clean and flush each part in clean fuel oil just before reassembly. Apply a clean plastic plug, Part 147X1693, to the inlet connection in the pump housing.

CAUTION: *If any trace of magnetism exists prior to cleaning, all components must be demagnetized. This will ensure removal of all metal particles during the cleaning process.*

1. Secure the pump housing (25) upright in a soft padded vise or holding fixture, Part 147X1732. Slide the erosion sleeve (15) into the housing.

CAUTION: *If the erosion sleeve (15) is omitted from the assembly procedure, irreparable damage will be done to the housing and other parts.*

2. Align the locating groove of the barrel with the dowel pin (26) in the housing (25), and slide the barrel down into the housing.

NOTE: *Dowel pin (26) should protrude 0.068-0.072 in. into the housing bore. This will allow the barrel to slide easily into position, but will not allow the barrel to rotate.*

3. Guide the delivery-valve assembly (14) into the housing.
4. Install the delivery-valve stop (11) in the delivery-valve spring (12). Then, place the spring and stop assembly on the valve of the delivery-valve assembly.
5. Slide the delivery-valve holder (10) into the housing, and seat it on the delivery-valve stop.
6. Lubricate new preformed packings (9 and 13). Install the packing (9) in the groove of the small I.D., and install the packing (13) on the middle outside flange of the delivery-valve holder nut (8).

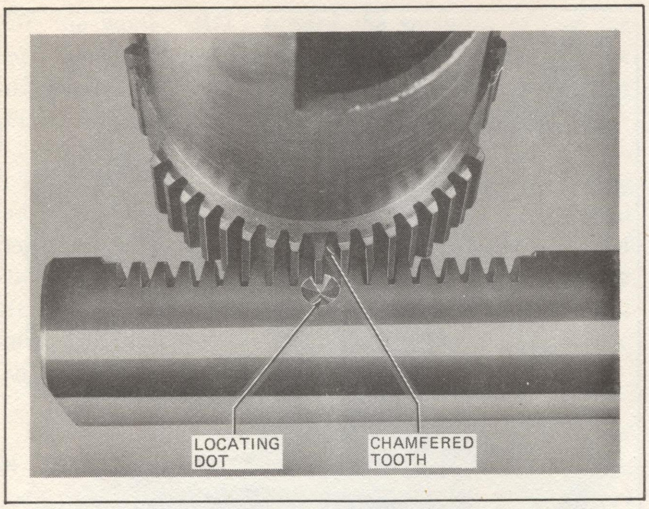


FIG. 13, E-22703

FIG. 13. ALIGNMENT OF CONTROL SLEEVE TO CONTROL RACK.

CAUTION: *If the preformed packing (13) is installed in the housing, the delivery-valve holder nut will cut the packing, causing external fuel leakage.*

7. Screw the delivery-valve holder nut (8) into the housing. Torque to 500 to 525 lb.-ft.
8. Slide the control-rack assembly (17) into the housing.

NOTE: *Each time a pump is overhauled, the control-rack locating screw (16) must be discarded.*

Tighten the new control-rack locating screw (16). The screw must enter the groove in the control rack to be locked. Back the screw off 1/2 turn. This will allow the control rack to move back and forth freely, while limiting movement.

9. Invert the pump and install the control sleeve (7). When installing the control sleeve, internal positioning of pump parts, which affects calibration, is involved. Install the sleeve so the chamfered tooth on the control sleeve meshes between the two teeth that are indicated by the locating dot on the control rack (17). With adequate lighting, this is easily accomplished, Fig. 13.
10. Carefully start the plunger into the barrel. If the plunger is started squarely, it will settle into the barrel by its own weight. Turn the plunger so that the marked end of the crossbar will go into the control sleeve slot that has a mark adjacent to it, Fig. 14. This will properly locate the metering helix relative to its respective spill port. Check the backlash between the plunger (4), control sleeve (7) and control rack (17). To do this, hold the plunger (4) in a steady position while attempting to move the control rack (17) back and forth. If the backlash is 0,5 mm (0.020 in.) or more, disassemble the pump, and replace one or more of the worst-worn parts until a backlash of less than 0,5 mm is obtained.

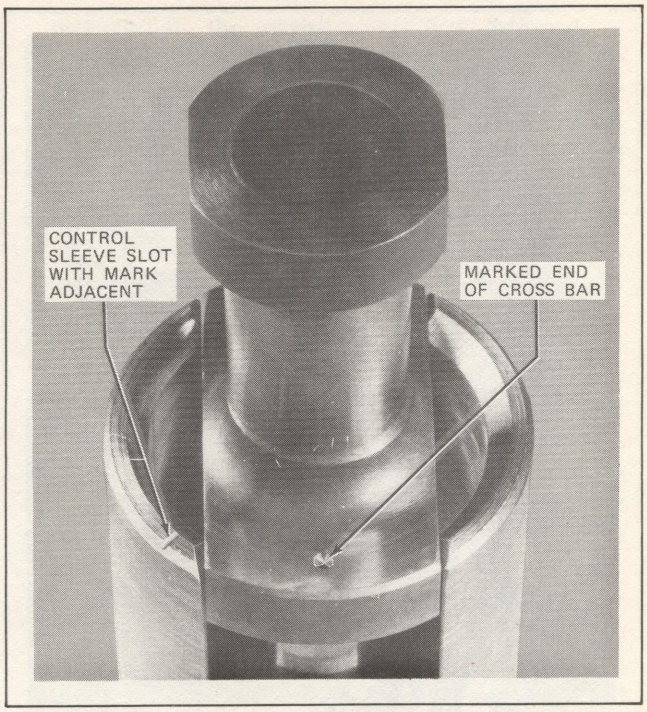


FIG. 14, E-22704

FIG. 14. ALIGNMENT OF PLUNGER TO CONTROL SLEEVE.

11. Place the upper spring plate in the housing with the worn side toward the top of the housing. This will reverse the wear pattern. Slide the spring (5) down on top of the spring plate.
12. Position the lower spring plate (3) on the end of the plunger. Be sure the plunger crossbar is aligned with the slots in the control sleeve and the marks are adjacent. Fit the plunger follower (2) into the housing. Depress the plunger follower to be sure it will move in the housing. If the follower will not push down far enough, it indicates the plunger crossbar did not enter the control-sleeve slots. In this case, remove the follower and the lower spring plate, and realign the crossbar.
13. Place the pilot (1) on the threads in the bottom of the housing (pump body). Depress the follower (2), and install the pilot into the housing. Torque the pilot to 10-20 lb.-ft., using the applicable spanner. Remove the pump from the holding fixture.
14. After the pump is completely assembled, hold it horizontally, with the control rack vertical. The rack

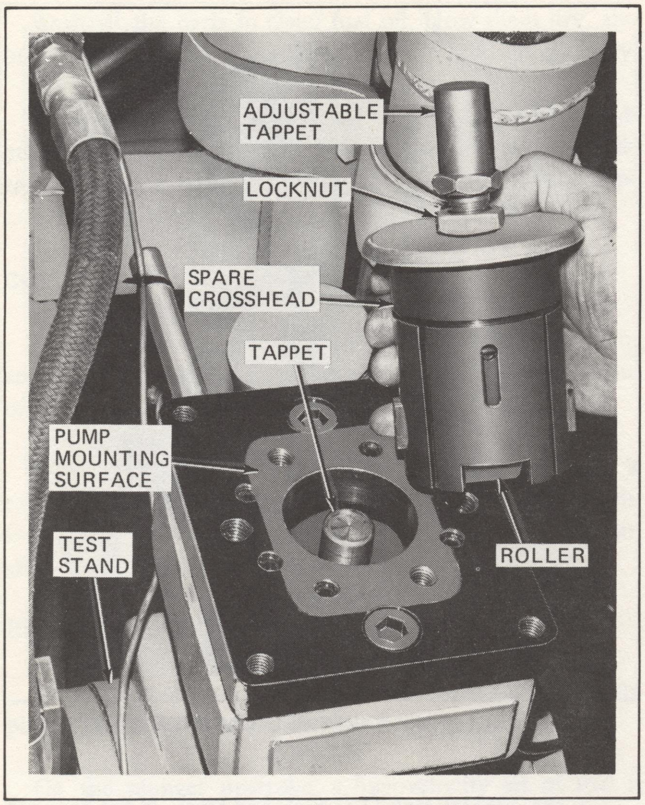


FIG. 15. TEST STAND SHOWING CROSSHEAD IN PLACE AND A SPARE CROSSHEAD.

FIG. 15, E-25141

will settle to its lower extreme by its own weight. A final check will be made of this rack freedom under operating conditions under the calibration instructions which follow.

FUEL PUMP CALIBRATION

PRELIMINARY

CAUTION: *Make certain cam is rotating in the correct direction, that is, fast-rise portion of cam must make first contact with crosshead roller.*

To calibrate fuel injection pumps, they must be operated on a suitable test stand, Part 147X1736-1 or 147X1737-1, at an approximation of engine operating conditions.

The test stand must be equipped with a 20 mm lift cam, Part 147X1533, and the crosshead tappet, Fig. 15, adjusted and locked so the dimension from the top of the tappet to the pump mounting surface, Fig. 16 is 0.253 to 0.259 in. (6,43 to 6,58 mm) when the crosshead roller is on the base circle of the cam.

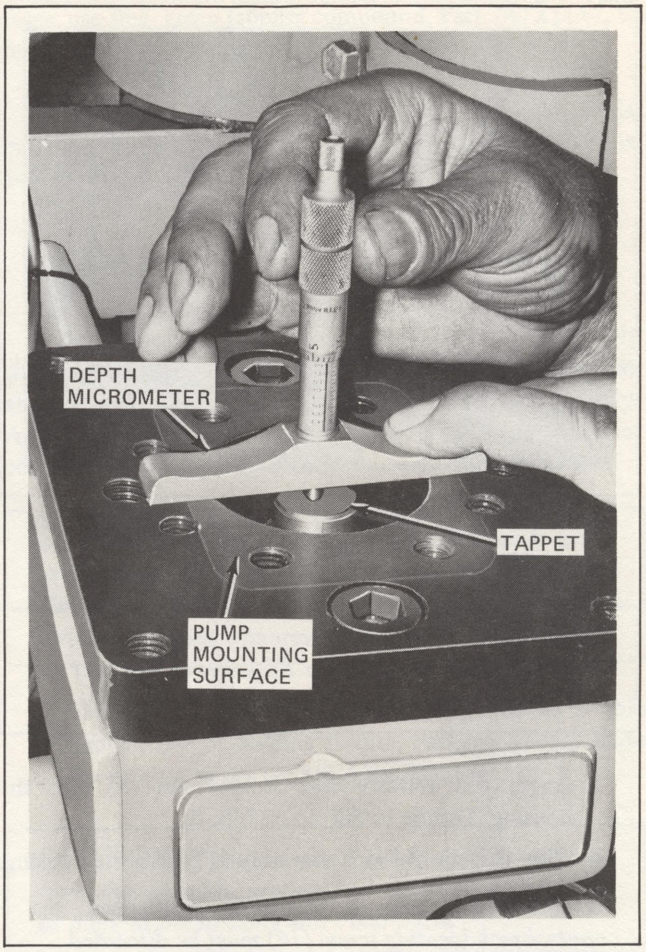


FIG. 16. MEASURING THE DIMENSION FROM PUMP MOUNTING SURFACE TO TOP OF TAPPET.

FIG. 16, E-25142

Two or more master pumps, which check alike at both 23 mm and 6 mm rack settings, should be available for use with the test stand. The MASTER pump, Part 147X1635, should be used only for qualifying the other master pumps, which are called WORKING-MASTER pumps. When not in use, the MASTER pump should be kept in a secure location and treated to protect it from environmental damage. Before and after each batch of pumps is tested or calibrated, the stand and equipment should be qualified by making two check runs using one WORKING-MASTER pump, with all other factors – nozzle, orifice plate, fuel line, test oil condition, and test operation – remaining the same.

Periodically (monthly, quarterly, semi-annually, or annually), depending on quantity of pumps checked, the WORKING-MASTER pump(s) should be checked against the MASTER pump. If the WORKING-MASTER pump has become worn or damaged, it will be detected and can be replaced or corrected. Any new Part 132X1254-1 pump that matches, or can be made to match, the fuel delivery of the MASTER pump can be established as a WORKING-MASTER pump.

A master nozzle may be purchased complete as Part 147X1636. The orifice plate must always be assembled with the word "OUT" toward the spray-tip end of the nozzle and with the groove side of the plate adjacent to the nozzle valve assembly. Set the nozzle opening pressure at 3800 to 4000 psi.

The high-pressure, 1/8-in. inside diameter, 14-in. long fuel line furnished with the test stand is a standard Part 140X1826 fuel line used on the diesel engine. It is of suitable length to conveniently connect the pump discharge fitting to the master nozzle. The inside diameter, length and configuration of the fuel line must be maintained, or erratic calibration data will result.

The calibrating oil should be Part 147X1384 or 147X1152, or an equivalent non-foaming, non-flammable, non-corrosive mineral oil. The oil in the test stand should be preheated to 85-90 F by means of the fuel-temperature control dial and should remain constant within these limits.

CALIBRATION PROCEDURE

1. Mount a WORKING-MASTER pump on the test stand, and connect the suction line and the high-pressure line to the master nozzle. Make two or three qualifying runs to establish fuel delivery, in milliliters, at 6 mm and 23 mm rack settings. Use rack gage block, Part 147X1983, inserted between the face of the calibration screw and the rack rollpin to establish correct rack positions. Record the fuel delivery values obtained during this test. See the DATA section for test speeds and number of strokes to use for each rack setting. Remove the master pump, apply a plastic plug, Part 147X1693, to the inlet port, and apply a plastic cap, Part 147X1621, to the outlet connection.

2. Mount the pump to be calibrated on the test stand and connect the fuel lines. While operating the stand at 525 rpm (to warm-up the pump and bleed-out the air), set the control rack at approximately 23 mm.

   Check the rack for free movement. Use force indicator, Part 147X1958, and measure the force required to move the control rack in either direction while the pump is operating. The force required should not exceed 0.5 lb.

   Check for leaks around the delivery-valve holder (10), nut (8), fuel inlet, locating pin (26), and control rack (17) while the pump is running during the warm-up cycle and during the following calibration procedure.

3. Calibration – With the rack set at 23 mm, using rack-setting gage block, Part 147X1983, and running at 525 rpm, after two trial runs, take a reading of fuel delivery. If the quantity of fuel delivered, in milliliters, differs from the quantity delivered by the master pump by more than ± 1 percent, adjust thickness of calibration setting shims, Fig. 4 (22), reset the rack to 23 mm, and repeat the test. If necessary, repeat the preceding shim-adjusting procedure until satisfactory fuel delivery is achieved; that is, the pump being tested must match the master pump fuel delivery within ± 1 percent.

   Reset the rack to 6 mm and reduce the speed to 200 rpm, then check the fuel delivery under this condition. If fuel delivery matches that produced by the master pump within ± 10 percent, the pump is considered qualified; if fuel delivery is not correct, a slight shim adjustment may be made, as long as it does not seriously affect the delivery at the 23 mm rack setting.

   If it is impossible to achieve the correct fuel delivery in both rack positions, replace the plunger and barrel assembly and/or the delivery-valve assembly, and repeat the calibration procedure.

   After meeting the calibration requirements, remove the pump from the test stand and apply plastic protective cap and plug to fuel openings. If pump will not be installed immediately on an engine, fill inlet and outlet chambers with clean, anti-corrosive lube oil before applying plastic plug, Part 147X1693, and plastic cap, Part 147X1621.

4. When the batch of pumps to be tested is complete, requalify the test stand by re-running the WORKING-MASTER pump.

DATA

Fuel Injection Pump

Pump Timing (Beginning of Injection)	23 degrees BTDC
Plunger-Follower Wear at Tappet-Rod Contact or Plunger-Button Contact (Condemning),	
Max. on Either Side (in.)	0.015
Max. Total on Both Sides (in.)	0.015
Plunger-Button Wear (Condemning), Min. Thickness of Head (in.)	0.240
Lost Motion (Rack Travel), Max. Allowed (in.)	0.020

Pump Calibration Data Only

Calibration Equipment (See Tool Catalog for Latest Equipment):

	Part
Test Stand (230 volt, 60 Hz)	147X1736-1
Test Stand (230 volt, 50 Hz)	147X1737-1

DATA (Cont'd.)

Calibrating Oil (30 gal.)	147X1152-1
Calibrating Oil (55 gal.)	147X1384-1
Master Pump	147X1635
Master Nozzle (includes orifice plate)	147X1636
Orifice Plate	147X1746
Cam, 20 mm Lift	147X1533
Rack-Setting Gage Block (23 mm & 6 mm)	147X1983
Force Indicator	147X1958
Calibration Setting Shims	See GEG-16252
Plastic Fuel Inlet Plug	147X1693
Plastic Fuel Outlet Cap	147X1621

Calibrating Run Conditions:

	Rack Position By Rack Gage Block	
	23 mm	6 mm
Calibrating Oil Temperature IN (Degrees F)	85-90	85-90
Calibrating Oil Pressure IN (psi)	30-40	30-40
Injection Opening Pressure (psi)	3800, +200 –0	3800, +200 –0
Pump Strokes (Total)	300	500
Pump Cam (rpm)	525 ± 5	200 ± 5
Variation from Fuel Delivery of Master Pump (Percent)	± 1	± 10

Torque Values	lb.-ft.	N·m
Injection Pump Delivery Valve Nut	500-525	678-712
Injection Pump Pilot	10-20	14-27
Injection Pump Mounting Bolts	45-50	61-68

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